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REPORT

—TO THE—

Franklin Institute,

—OF THE—

STATE OF PENNSYLVANIA,

For the Promotion of the Mechanic Arts,

—RELATIVE TO—

The Metric System

—OF—

WEIGHTS AND MEASURES.

Philadelphia:

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1876.

REPORT

TO THE

Franklin Institute,

OF THE

STATE OF PENNSYLVANIA,

For the Promotion of the Mechanic Arts.

The Committee to whom was referred the circular of the Boston Society of Civil Engineers, asking the co-operation of the Institute "in petitioning congress to fix a date after which the metric weights "and measures shall be the only legal standards," respectfully report:—

The subject of weights and measures, which are *the instruments used in weighing and measuring*, has received the attention of all governments, and always with a desire to promote uniformity. The literature of the subject is copious.

Your committee will not repeat it, except so far as may enable us to determine the propriety of the proposed action. They refer to the admirable report of John Quincy Adams, Secretary of State, made to congress Feb'y 22, 1821,* and to the reports of the Board

* In Mr. Adams' journal, Feb'y 22, 1821, after speaking of sending to the Senate, the treaty with Spain for the cession of Florida, he says:

"I sent at the same time to both houses, the report upon weights and measures prepared conformably to a resolution of the Senate of March 3, 1817, and one of the House of Representatives, of Dec. 14, 1819."

"And thus have terminated, blessed be God, two of the most memorable transactions of my life."

. . . Of the report he says: "It is, after all the time and pains I have bestowed upon it, a hurried and imperfect work; but I have no reason to expect that I shall

of Managers of the Franklin Institute, made to the legislature in this state in 1834, published in the JOURNAL of that year, for the history of the subject and to the various encyclopedias for information as to the present state of metrology in France.

We are invited to adopt the system of France and to compel our people to use it. With her example before us as a guide, we may contrast with our own :

1. The condition of the weights and measures of France before her revolution.

2 The opportunity presented by the times when the French undertook their change.

3. The character and habits of the French government and people.

4. The system as originally designed by the French commission and as ordained by law.

5. The passive resistance of the people to the changes, the entire rejection and abolition of parts of the system (including all compulsory provisions), the compromise of 1812 in the adoption of the *système usuel*, in combination with the decimal metrical system originally forced upon the people, and the final establishment of this system in 1840.

6. The reasons for this resistance and reaction. And then, after a consideration of the immense number of fixed and recorded measurements now existing in this country, and of the expense, labor, and confusion which the attempt to change them would occasion, we shall perhaps be able to form an opinion as to the wisdom of such an attempt :

1. The condition of the weights and measures in France when the Bishop of Autun proposed a reform, may be described as legal confusion. In the memoir of the Bishop (afterwards Prince de Tallyrand) he enumerates 13 different lengths of the foot (*Pied*) in legal use, measuring from 120 to 150½ *lignes;* 18 different legal yards

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ever be able to accomplish any literary labor more important to the best ends of human exertion, public utility, or, upon which the remembrance of my children may dwell with more satisfaction."

The report is republished in Davies' Metrical System, Barnes, N. Y., 1871. It is a philosophical and judicial investigation of the subject, candidly stating the advantages and disadvantages of the various systems. Quotations from it may be made favoring either side.

(*Aunes*) measuring $299\frac{80}{100}$ to $597\frac{20}{100}$ *lignes;* 21 different legal pounds (*Poids de Marc*) weighing 6479 to 9767 grains; 24 legal *Boisseaux*, containing from 128 to 5157 cu. in.; 17 legal *sacs*, containing 3584 to 7349 cu. in.; 23 legal *septiers*, containing from 924 to 10,830 cu. in., 13 legal *Tonneaux*, containing from 12,203 to 97,989 cu. in., besides others, and adds, "this table is only a much abridged extract "of the principal differences between the weights and measures of "the kingdom."

The situation in France invited reform. There is no such diversity here. The weights and measures are by law, uniform throughout the United States, although slight diversity may exist in fact. The same motive for change does not exist here as existed in France.

2. The opportunity presented to France was peculiarly favorable for a change. The new system was struck out during the red heat of the revolution, during which the king was dethroned and beheaded, the nobles were killed wherever found, and their property, when they fled for their lives, was plundered or confiscated. The priests were driven from their cures, and religion was abolished. The christian era disappeared and the world began again at the year 1 of the French Republic, upon the 22d of September, 1792, "the day of the autumnal equinox, when the sun entered the sign of "the balance, the symbol of equality."

However, favorable to the introduction of a perfect system of weights and measures, your committee hope that no such opportunity may be presented in this country.

3. The government of France has always been in the habit of interfering with the private affairs of the people. For instance: the prices of butchers' meat and of bread are fixed by the prefects of police. A journeyman may not engage with a master mechanic without the permission of the same officers, etc., etc. The people are accustomed to this parental care, and would feel lost if it were withdrawn. They will, if necessary, rise up and destroy the government, but while it *is* the government, they are accustomed to feel its hand in their private affairs. A law, which proposed to abolish the old weights and measures in use, and the old habits of the people in weighing, measuring, and trading, and to substitute new ones with new names, would be more likely to be obeyed when enacted by the government of France than by that of the United States.

This government is authorized by the constitution to "fix the standard of weights and measures." It would be questioned whether this power "to fix," meant to change, to abolish, and to substitute new and foreign weights and measures. Our general government has never undertaken to enforce the laws to maintain the existing standards. The supervision of the subject has always been the care of the separate States. A law of the United States, such as proposed, would probably be a dead letter unless enforced by means which the people would not submit to. The American idea of government duties is, that it should do and enforce justice, and that Liberty in all things innocent, is the birthright of the citizen.

4. The system established by the French, and the difficulties of the undertaking, may best be understood from a brief chronological sketch.

In 1790, Talleyrand addressed a memoir to the constituent assembly, setting forth the condition of the existing metrology and proposing to establish a new system for all France, whose primary unit should be the length of a pendulum beating seconds, as a natural standard. His proposition did not embrace a decimal system.

A decree, adopting the proposition, but with serious modifications was sanctioned by the king, Louis XVI, upon the 22d of August, 1790.

In execution of this decree, a committee of the Academy of Sciences was appointed to examine and report upon the subject. The report was made August 19th, 1791. It proposed the ten millionth part of a quadrant of the meridian as a natural standard unit of lineal measure to be applied as a measure of matter in its three modes of extension, length, surface and solidity; and as a secondary standard of comparison with this unit, the length of a pendulum vibrating one hundred thousand beats a day. The weight of distilled water contained by a cubical vessel in decimal proportions to the lineal measure, was to be the standard unit of weight. The whole system of weights and measures was to be composed of multiples and subdivisions of these units according to the decimal system. The report recommended that the quadrant of the arc of the meridian should be divided into 100 degrees instead of 90, as before. The decimal division of time also was part of this plan.

To carry this plan into effect it was necessary, with the utmost accuracy, to measure the arc of the meridian, to weigh the ascertained

bulk of water, and to find by experiment, the length of the pendulum beating 100,000 seconds per day. The report being sanctioned, the execution of the scientific observations was immediately begun, but was not completed before seven years, owing to numerous interruptions, occasioned by the overthrow of the government and the abolition of the Academy of Sciences.

Upon the 5th of October, 1792, the new calendar was established by law. It made 100 seconds in a minute, 100 minutes in the hour, 10 hours in a day, 10 days in a week, 3 weeks in a month, and 12 months in a year. Thus 100,000 seconds made a day, 30 days made a month, and 360 days a year. The five or six odd days in the natural year, having no month to cover them, were called in derision *Sans Culottides*, or, days without breeches, and were devoted to games and frolics.

The quadrant of the circle was also divided decimally into 10 parts and each part into 10 degrees. The quadrant of the meridian containing 100 degrees of 100,000 *metres* each, was to be 10,000,000 *metres*, and the circumference of the earth, forty millions of *metres* in length.

The universe, under this system, might be compared to a great French clock, having the earth for its escape wheel, whose equatorial motion would be 400 *metres* per second.

The National Assembly, impatient at the delay in establishing the definitive *metre*, decreed upon the 1st of August, 1793, that the system should go into operation immediately, based upon a measurement of a degree of the meridian made in 1740, which made the length of the *metre* $443\frac{44}{100}$ *lignes* of the ancient French foot. This decree adopted a complete nomenclature of all weights and measures for lines, surfaces and solids. The length of the *metre*, and values of all measures derived from it, were to be provisional and lawful until the final determination of the correct figures. The new nomenclature and the use of 100,000 seconds per day, were made compulsory by the law of 24th November, 1793.

By the law of 7th April, 1795, some of the names were changed and the existing nomenclature of the French metrology was *definitively* established, although the sizes of the weights and measures were *provisional* only. This law provided that the weights and measures might be made of the units, ten units, the double units, half units, and tenth units, but no other multiple or subdivision, such as

$\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, should be made or used. The same law re-established the scientific commission for the work of determining the definitive *metre*, etc., and repealed so much of the law of 24th November, 1793, as obliged people to use 100,000 seconds in a day.

The arc of the meridian between Dunkirk and Barcelona was measured by Messrs. Delambre and Mechain, with great accuracy. It comprehended about $9\frac{2}{3}$ degrees of latitude. The measurement was continued south by Messrs. Borda and Biot to the island of Formentara, so as to comprehend 12 degrees of latitude, of which, 6 were south of the 45th parallel, and 6 north of it.

The degrees of latitude were found to be of different lengths and the differences followed no law. An average was therefore taken, and then the length of the *metre* was determined to be $443\frac{296}{1000}$ *lignes* of the old French foot (being $\frac{1}{100}$ of an inch less than the provisional *metre*) and equal, according to the measurements of the French Academy, to 39·3827 in English; of Captain Kater (English), 39·37079; of Mr. Hassler (U. S. Coast Survey), 39·3802. Doubts have been thrown upon the correctness of all these measurements.

The length of the pendulum vibrating 100,000 seconds per day at Paris was found to be ·74193 *metres* (29·2192 in.), from which was afterwards deduced by calculation, the length of the pendulum vibrating the usual seconds of 86,400 a day, equal to ·99383 *metres* (39·1393 in.) or $440\frac{56}{100}$ *lignes* of the old French foot.

The weight of distilled water contained in a cubic *decimetre* was found to be $18{\cdot}827\frac{15}{100}$ grains French, equal to $15{\cdot}445\frac{72}{100}$ grains troy, which is the weight of the *kilogramme*.

The capacity of the vessel containing this water is the capacity of the *litre*, which is equal to 61·02624 cubic inches. This is the standard unit for wet and dry measure.

The principle of decimal arithmetic was applied to all these units. The multiples were tenfold, and the subdivisions were tenths, so that in any sum representing French measures, each figure has ten times the value of its right hand neighbor. To all the multiples of the system, Greek words are prefixed, and to all the subdivisions, Latin words.

The actual standard measures of the *metre* and the *kilogramme* were deposited with the keeper of the public archives, with great form and ceremony, upon the 22d of June, 1799.

The temporary weights and measures provided by the law of August 1st, 1793, were abolished and the definitive substitutes were established by law upon the 10th of December, 1799.

The establishment of the French decimal metrical system has thus far been described. The process of modification and repeal of compulsory measures followed. We have already seen that the law of April 7th, 1795, repealed the compulsory use of the second of $\frac{1}{100,000}$ of a day. This was a revolt against "decimal despotism."

On the 8th of April, 1802, a law was made, retaining the republican calendar for civil purposes, but restoring the week of seven days and the old Sundays.

By the law of November 23d, 1802, the wine trade was relieved from the compulsory use of the new system, which required that the casks should contain a decimal number of *litres*. It was now permitted that the casks might be made of the ancient sizes and the contents in *litres* branded upon them. In the newspapers at Bordeaux the prices current at this day are quoted by the *tonneau* of 4 *bariques*.

On the 9th of September, 1805, the new calendar (after an existence of twelve years) was abolished, and the ancient calendar was restored, so that January 1st, 1806, reappeared.

On the 12th of February, 1812, an imperial decree, executed by an ordinance of 28th of March, following, abolished the compulsory provisions of the decimal system so far as to permit the use, for the purposes of commerce, of the following weights and measures:

Lineal measure.

Toise = 2 *metres*, divided in 6 feet. On one side divided into *decimetres*, and the first division into *millimetres*.

Pied = $\frac{1}{3}$ *metre*, divided in 12 inches, each inch in 12 lines. On one side divided into $3\frac{1}{3}$ *decimetres*, and subdivided into *centimetres* and *millimetres*.

Aune = 1·2 *metres* divided into $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{12}$. On one side marked in decimals of *metres*.

Capacity.

Boisseau = $12\frac{1}{2}$ *litres*, also its double, half and quarter.

Litre = also its subdivisions of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$ for retail sales of wet and dry measure.

Weight.

Livre = $\frac{1}{2}$ *kilogramme* or 500 *grammes* = 16 *onces*, also subdivisions of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$ths.

Once = 31·25 *grammes* = $\frac{1}{16}$ *livre*, also subdivisions of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$.

Gros = 3·90625 *grammes* = $\frac{1}{8}$ *once*.

Thus after twenty years of contest and confusion, the old names and the old subdivisions were restored, but with new and uniform values.

This led to many years of confusion and fraud, followed by another change, decreed by the law of July 4th, 1837. This law was executed by the royal decrees of April 17th and July 10th, 1839, and put in operation in 1840, when the existing decimal metrical system was finally established, after a struggle of 47 years, a period of two generations, during which the entire active population of France was changed.

The preceding history is given to show the extreme difficulty of effecting a change in the weights and measures used by the people, even when a reform was most needed, because of the greatest confusion and diversity of the weights and measures in use, and when the change was enforced by the most bloody and arbitrary despotism of modern times, favored by the best of opportunities.

Although the *metre* was drawn from the circle and the sphere, these two forms resisted the application of the decimal metrical system. The measurements of time, of the degrees of the circle, of navigation, geography and astronomy, successfully rejected it, although the prime idea of the Commission was to connect these subjects with ordinary weights and measures, by making the *metre* (the 40 millionth part of the circumference of the earth), *the unit of lineal measure*, and the *second* (the hundred thousandth part of the day) the *unit of time*, by means of the pendulum beating 100,000 seconds. The *metre* and the *second* were then the intermediate links in a long chain connecting science and practical life, having the solar system at one end, and a quart measure at the other. It is singular that the parts of this chain applicable to the calculations of science, were at once abandoned for their inconvenience; and the parts applicable to the uses of yard sticks, pound weights, and quart measures, were imposed upon the people by compulsory laws for nearly twenty years, without regard to the still greater inconvenience to them.

Excuse for this partiality may be found in the facts, that the division of the day into 86,400 seconds, and of the quadrant into 90 degrees, was uniform throughout France, and throughout the world; that, although the day and the quadrant were not decimally divided, they were conveniently divided according to the nature of things; that there was a great value invested in the clocks and watches, and instruments for measuring time and circles, and in the tables and

calculations already made for the purposes of navigation, mensuration and astronomy, which would become useless if the changes were persisted in.

In fact, there were all the reasons for not making these changes, which we have now against the changes proposed to us; and there was no stronger motive. These reasons prevailed, and these changes were abandoned.

From these remarks we may infer why the French people resisted a reform conferring such benefits upon the nation, and perfecting its unity. Of course, the first objection was that it was a change; a change which required them to unlearn much of their little learning, to abandon many of their old customs, and to embrace new things with outlandish names. The philosophers laughed at this reason, but they yielded to it themselves.

If this objection had existed alone, the strong hand of the government—persisting for twenty years—must have conquered it. But there were other and more enduring reasons. The new system was not so perfect as to be in all cases preferable to the old. The usual divisions and subdivisions of weights and measures are the result of the natural selection of thousands of years, and they are in harmony with the daily wants and usages of practical life, requiring divisions of quantities into halves, thirds, quarters, sixths, and eighths, not always convenient in decimals.

But whatever were the controlling reasons which incited the opposition to a change in France, they have much greater force with us from the absence of motive. We have no such confusion and diversity as the French had, and no such reform is called for. Our money is already decimally divided, and we enjoy already the chief benefits which the new system gave to the French.

If the measurements of the weights and the dimensions of substances, when ascertained, were only to serve as data for complicated calculations, the reasons for adopting weights and measures decimally divided, would have controlled the practice long ago. This is actually the case with us; in surveying land, which is measured by chains twenty-two yards long, divided into one hundred links; in civil engineering, when embankments, excavations, etc., are measured by yards and tenths, or feet and tenths, as the case requires; in the measurements of ships for tonnage, when the three dimensions are taken by feet and tenths; and in gauging casks, which is done with a gauging rod marked in inches and tenths.

But the fact is, that the vast majority of weighings and measurings are followed merely by mental calculations; or, by a simple multiplication of quantity (whole or fractional) by price (in decimals), a process which can oftener be done by vulgar fractions, more easily than by decimals.

The *metre* is really as arbitrary a standard as the foot. About 80 degrees of latitude have been measured, but no two of them have been found of the same length, and there is good reason to believe that the length is not permanent in the same place. The only real thing about it is the rod in the public archives. The length of the *metre* is to be recovered, if lost, by comparison with the length of the seconds pendulum, and so likewise is the length of the foot or yard.

The *metre* was adopted in France for the lineal unit, in preference to the length of the seconds pendulum, only because the harmonious proportion between the *metre* and the length of the meridian would bring all local measurements into harmony with the measurement of the world, and would be a great assistance in geography and navigation; but the decimal divisions of the quadrant and of time, having been abandoned, and the adopted length of the *metre* having been found incorrect, there remains not even a sentimental reason for our adopting it as our unit of measure. Our own convenience should be our guide, and overwhelming reasons forbid us to incur the confusion, labor and expense of attempting to make a change of that kind.

In the opinion of your committee, the *metre* in any shape heretofore adopted, is a less convenient instrument for measurement than a two foot rule. You cannot fold it into four without breaking the sub-units. If so folded, it would be ten inches long, which is inconvenient for the pocket. The *metre* is only decimally divided, whereas the foot rule, besides being divided into tenths and hundredths, is also divided into twelve inches, and gives the even $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$, $\frac{1}{12}$ and $\frac{1}{100}$ of the foot, and the $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{10}$, $\frac{1}{12}$ and $\frac{1}{16}$ of the inch.

By changing our unit of lineal measure for the sake of uniformity with France, we should sever our uniformity with Great Britain, a country with which three-fifths of our foreign commerce is transacted.

The change in our units would entail much greater expense than is usually imagined. The measurements of every plot of ground in the United States have been made in acres, feet and inches, and are

publicly recorded with the titles to the land, according to the record system peculiar to this country. Hundreds of years would elapse before we could permit ourselves to forget these old measures. Besides this, the industrial arts during the last fifty years have acquired a far greater extent and precision than were ever known before. Take, for instance, the machine shops, in which, costly drawings, patterns, taps, dies, rimers, mandrils, gauges and measuring tools of various descriptions for producing exact work and repetitions of the same with interchangeable parts, are in common use.

It has been calculated that in a well regulated machine shop, thoroughly prepared for doing miscellaneous work, employing 250 workmen, the cost of a new outfit adapted to new measures, would not be less than $150,000, or $600 per man.* If, instead of changing the sizes, we adopt the alternative of giving the French dimensions to the old sizes, the irreconcilable discord between the inch and the divisions of the *metre*, would furnish a precious example of the simplicity of the decimal system.

If new weights and measures are to be adopted, all the scale beams in the country must be regraduated and readjusted; the thousands of tons of brass weights, the myriads of gallon, quart and pint measures, and of bushels, half bushels and peck measures, and every measuring rule and rod of every description throughout the land, must be thrown aside, and others, which the common mind cannot estimate, must be substituted.

The great mass of English technical literature would become almost useless, and must be translated from a language which we, and the nation we have most to do with, understand perfectly, into a new tongue, which is strange to most of our people. As a question of cost, let those who advocate this change consider it carefully.

To the teacher, to the closet scholar, to the professional man, to those who never handled a rule or a measure, but only use weights and measures in calculation, it may seem merely a matter of legal enactment; but to the worker, the dealers in the market places, to those who produce the wealth and prosperity of the land, the question is a most serious one.

The Franklin Institute has never placed itself on record as opposing true progress; it has always advocated changes which were

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* See "The Metric System in our workshops, &c.," by Coleman Sellers—JOURNAL OF THE FRANKLIN INSTITUTE, June, 1874.

beneficial and not destructive. In this case, a majority of your committee believe that the ultimate benefits of the change proposed, would be of less value than the damages during the transition. They think that the government of the United States has already done all that can fairly be asked of it by the most enthusiastic advocate of the metrical system, by making it legal. Those of us who choose to do so, can use that system, and no one can object to it; but, for the government to require us to use that, and no other, would be an arbitrary measure which we are neither willing nor able to bear.

The majority of your committee are of opinion, and so report, that the objections to the attempt to adopt the *metre* as a standard unit of lineal measure, are overwhelming, whether we consider the compulsory means proposed, or the end to be attained.

All of the objections to the metrical decimal system do not apply to the adaptation of the decimal scale to our existing units. In the decimal harmony between the cubic foot and its content of water weighing 1000 ounces avoirdupois, whereby a cube of $\frac{1}{10}$ of a foot on the edge becomes the measure of the ounce of water, we have the means of constructing a decimal system of weights and measures which would interfere the least with existing institutions. But your committee do not feel called upon to consider this branch of the subject.

COLEMAN SELLERS.

W. P. TATHAM,

Chairman.

Philadelphia, April 19th, 1876.

THE FRENCH METRIC SYSTEM AT THE FRANKLIN INSTITUTE.

Discussion on the subject by Mr. John W. Nystrom, at the stated meeting May 17, 1876.

Vice-President Charles S. Close, in the chair.

Mr. President, and Members of the Institute:

I beg permission to make a few remarks upon the report of the Committee on Weights and Measures.

The circular of the Boston Society of Civil Engineers, asking the co-operation of the Franklin Institute in petitioning Congress to fix a date after which the metric weights and measures shall be the only legal standard in this country, was referred to a committee which has made one majority and one minority report.

The majority report has been printed and circulated in pamphlet form, as if approved by the Institute, and is opposed to recommending the adoption of the metric system in this country; to which opposition of the Committee, I have no objection: but before that report is adopted by the Franklin Institute, it is desirable that it should be based upon tenable ground, and not uttered in that spirit of depreciation of the metric system, and of the French nation which seems to have inspired the Committee.

That nation deserves great consideration for its struggle to introduce a universal system of metrology; an enterprise which, although universally desired, no other nation has ventured to undertake.

The majority report expatiates upon objections to the introduction of the metric system in this country, which are of mere temporary and insignificant import, very much like the English objections to the introduction of the Arabic figures for the Roman notation some 300 years ago.

The English were about 400 years behind the Continental nations in the introduction of our present Arabic digits.

The English thought that the introduction of the Arabic figures for the Roman notation, would obliterate all records and reckoning, and they expatiated upon the great difficulty and expense in making the alteration.

Now, the majority report on weights and measures to the Institute, is conceived in the same spirit, in regard to the introduction of the metric system.

What would our technical books, our arithmetic, reckoning and records be to-day with the Roman notation?

At the April meeting of the Institute, it was remarked that the majority report was *practical*, and the minority report *theoretical*.

In England, about 300 years ago, the Roman notation was considered *practical*, and the Arabic notation *theoretical*, and this identical distinction beween *practice* and *theory* appears to prevail at the Franklin Institute to day.

The terms *practical* and *theoretical* are promiscuously used at the Institute, as a means of support to sciolism and ~~evasion~~ perversion of the truth.

The difficulties which the French have experienced in establishing and introducing the metric system, are not tenable reasons for rejecting its adoption in this country.

The difficulties Fulton had in introducing steam navigation, are to day no objections to its use.

The same can be said about Morse and the telegraph, and many other valuable advances upon which our progress and prosperity depend.

The Republic of Switzerland and other nations who from French example have adopted the metric system, did not experience the difficulty with their *reamers* and *mandrils* as intimated in the "practical" report.

The duty of technical and scientific men should be to consider, investigate and explain impartially, the comparative merit and demerit of the French and of our present system of metrology in all their bearings, and leave it for the law-makers to decide whether or not it would be expedient to introduce, or if necessary to enforce the metric system upon us. The majority of our committee, however, has taken it upon themselves to speak, not only for the Franklin Institute, but as though they represented the entire United States.

We have no substantial reasons for supposing that our lawmakers would enforce unjust laws, and the Americans are generally a

law-abiding people upon whom various laws are enforced every day. It is not for the Franklin Institute to decide whether or not the introduction of the metric system in this country would be an unjust law.

We know from experience, history and tradition, that in all parts of the civilized world, communities do not always comprehend their true interests, and it has therefore been found necessary some times, to enforce laws by which to guide them into prosperity, as was the case in England, with the introduction, adoption and enforcement of the Arabic figures for the Roman notation before mentioned.

The enforcement of the Arabic figures in England, was made at the expense of burning the Houses of Parliament.

In case our law-makers should find it expedient to introduce or enforce the metric system upon us, they will no doubt give at least ten years' notice, in which time the present *reamers* and *mandrils* in a toolshop may be worn out, and if not, they will not be likely to conflict with any clause in the new law.

The "practical" Committee says, "the Franklin Institute "has never placed itself on record as opposing true progress." This statement conflicts with the tenor of their report, and moreover cannot be sustained in an impartial argument.

The Committee is "favorable to the introduction of a perfect "system of weights and measures," but they at the same time "hope "that no such opportunity may be presented in this country."

If this paradoxical language is approved by the Franklin Institute, it may be interpreted and understood that this Society favors progress, but will not give any opportunity for it. I admit that to be true, because I have experienced the fact, but fear that such acknowledgment on the part of the Committee would weaken the strength of their report.

The Committee refers to an article published in the Journal of the Franklin Institute, headed, "The Metric System in our Workshops," which article contains the same kind of feeble ideas on weights and measures, as those in the "practical" report.

The "practical" Committee says: "The universe under this "(metric) system, might be compared to a great French clock, having "the earth for its escape-wheel, whose equatorial motion would be "400 metres per second." They evidently expect that such a "practical" idea is good enough to be approved by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

The "practical" report is intrinsically imprudent, and, moreover, is ungrateful to the French Government and people, and if adopted as it now reads, it will *stamp a mark of old-fogyism* upon the Franklin Institute, which can never be wiped out, and under no consideration can that report accomplish the effect intended by its authors.

I beg to be distinctly understood, that I do not advocate the introduction of the Metric System, nor am I against it or opposed to it; but only desire to see dispassionate justice done to it, and therefore feel it a duty to remonstrate against an unphilosophical and hasty disposition of so grave a subject, by a prejudiced Committee of our Society.

The tenor of the "practical" report, moreover, seems to border so closely upon arrogance and partiality, as to be scarcely admissible by any institution of learning.

A report of this kind ought to be devoted principally to substantial and essential facts bearing directly upon the expediency or inexpediency of introducing the metric system as the only legal standard of weights and measures in this country.

We ought not to encourage or countenance the expression of sentiments of vain-glory in our reports, indicating that the Franklin Institute is an infallible or oracular Institution, and that the Americans or republicans are better people than those of other nations. I admit that these qualifications are true, and it is well enough for us to think so and talk about it amongst ourselves, but not to promulgate it officially from an Institution of learning.

Under these impressions, Mr. President, I respectfully move that the majority report be returned to the Committee for reconsideration and revision.

The motion was seconded, but the President paid no attention to it. Strong efforts were made by the "practical" element to have the "practical" report adopted and published in the Journal.

A synopsis of the minority report was read, which protested against the majority report as a perversion of history, and the assumption that the present system is the best that can be devised: also the argument that the change will be attended with great cost. Mr. Washington Jones moved to adopt the majority report.

Mr. Orr moved as a substitute for Mr. Jones' motion, that both reports be accepted and printed in the Journal. Mr. Jones again moved the adoption of the majority report, and its transmission to the Boston Society of Civil Engineers.

On motion, the subject was postponed until next stated meeting.

B. P. L. BINDERY.
SEP 18 1878